**Analysis of Functions**

**Instructional Plan 2014-2015**

**Mathematics Instructional Plan Writing Committee**

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| **School Board Members:**Karen AlmondTina Calderone, Ed.D.Amy LockhartDede Schaffner**Superintendent:**Dr. Walt Griffin**Deputy Superintendent:**Dr. Anna-Marie Cote**Secondary Executive Directors:**Dr. Michael BlasewitzDr. Robin Dehlinger**Department of Teaching and Learning**Dr. Corbet WilsonDiana Barnett | **Middle School Contributors:**Sandy Baldorossi – TWMS Jennifer Bennett – MKMSPatty Bouington – SMSAllison Child – SMS Diane Firios – SSMS Mary Ellen Freeman – MMMSSara Gibbs – MWMSKelly Goodearl – ITMS Kim Hamilton – ITMS LeeAnn Heldmyer – TWMS Joni Hudson – SMS Stephanie Johnson – MMMSBeth Karnes – ITMS Adam Kiefer – SSMSElena Lugo – RLMSJennifer Manwaring – TWMS Stuart Milchman – MMMS Lisa Morris – MMMSMichelle Mouton – JHMS Misty Naran – LCMS  | Triscia Panarello – SMS Sabrina Robinson – MWMS Robyn Smith – MKMS Erica Sowpel – SMS Kristen Springfield – MKMS Jennifer Stickle – MMMS Deborah Velez – LCMS Dennis Whalen – ITMS Barbie Wigen – MMMSAgnes Wong – SMS | **High School Contributors:**Ryan Beasley – LMHSSusan Brown – LHSBrittany Campbell – HHSAglaia Christodoulides - HHSKatie Donoghue - LMHSLauren Fedi - OHSMatt Guglielmello – OHSDavid Hiller – LMHS Saida Hussien – OHS Amy Jones – LBHS Mia Keyeser – LMHS Angela-Mia Kilmer – OHS Jeffrey Miller – LBHSKaren Neukamm – LBHS Laura Pollard – LHS Jonathan Rodriguez – HHS Kristina Rudich – LMHSLesley Schmidt – WSHS Erica Segrest – OHS Sharon Shyrock – LHS Lynn Webb – LHHS Betty Westhelle – OHS |

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We would like to express our appreciation for the time, effort and expertise contributed to the writing of the secondary Mathematics Instructional Plans by our team of Seminole County math teachers.

**Purpose:**

The purpose of the Seminole County Public Schools Instructional Plan is to present an organized, responsible strategy of Benchmark presentation that incorporates Mathematics Formal Standards (MAFS) standards. This document will serve as a guide for teachers of mathematics. Latitude in the execution of this document shall be determined by a school rather than by an individual teacher.

**Goals:**

* To establish a classroom environment that values mathematical student discourse
* To engage students in cognitively challenging mathematical tasks
* To promote discussions that focus on student thinking, reasoning, problem solving and student presentation
* To build on student thinking while ensuring the discussion remains focused on the mathematical ideas of the lesson
* Employ questioning techniques that require students to justify, defend and support their ideas

**Instructional Plan Caveats:**

* Suggested practice corresponds to the associated lesson and left at the discretion of the instructor to be used as additional practice or assignment. Problems within the suggested pages may be exhausted or selected for targeted skills.
* Descriptions of the Mathematical Practices can be found on pages 3 – 4. Teachers are encouraged to embed the Questions to Develop Mathematical Thinking on pages 5 – 6 in their daily lessons.
* Learning goals and scales can be accessed through the hyperlinks within the Instructional Plan.
* Each learning scale will include links for formative assessment tasks that teachers are encouraged to use while students are progressing through the learning scale.
* Teachers are encouraged to use appropriate questioning strategies to fully address the instructional standards and expectations, by paying attention to the recommended caveats included throughout the IP to include discussion that may not be included as part of the textbook.
* Please look ahead and plan accordingly for time and copy needs that may arise throughout this year so that all MAFS standards are thoroughly addressed.
* Due to the fact that we do not have Test Item Specifications at this time the targeted Mathematical Practices for each unit are a projection.
* **Common Assessments need to be readdressed by PLCs to fit the new units and fully address the standards.**
* **Each unit will include at least one learning goal listed under the unit heading. The learning goals and scales correspond to the grade/level specific clusters as defined by the MAFS.**
* **The learning goals and scales are a work in progress and may be modified as needed. They are meant to be a starting point for PLCs to use as they customize the learning goals and scales to best demonstrate student learning**.

**STANDARDS FOR MATHEMATICAL PRACTICE**

1. **(MAFS.K12.MP.1.1) Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

1. **(MAFS.K12.MP.2.1) Reason abstractly and quantitatively.**

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**3. (MAFS.K12.MP.3.1) Construct viable arguments and critique the reasoning of others.**

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**4. (MAFS.K12.MP.4.1) Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**5. (MAFS.K12.MP.5.1) Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**6. (MAFS.K12.MP.6.1) Attend to precision.**

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, student’s give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**7. (MAFS.K12.MP.7.1) Look for and make use of structure.**

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well-remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression *x*2 + 9*x* + 14, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see 5 – 3(*x* – *y*) 2 as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers *x* and *y*.

**8. (MAFS.K12.MP.8.1) Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation (*y* – 2)/(*x* – 1) = 3. Noticing the regularity in the way terms cancel when expanding (*x* – 1)(*x* + 1), (*x* – 1)(*x*2 + *x* + 1), and (*x* – 1)(*x*3 + *x*2 + *x* + 1) might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

| **Summary of Standards for Mathematical Practice** | **Questions to Develop Mathematical Thinking** |
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| **1. Make sense of problems and persevere in solving them.** |
| * Interpret and make meaning of the problem to find a starting point. Analyze what is given in order to explain to them the meaning of the problem.
* Plan a solution pathway instead of jumping to a solution.
* Monitor their progress and change the approach if necessary.
* See relationships between various representations.
* Relate current situations to concepts or skills previously learned and connect mathematical ideas to one another.
* Continually ask them, “Does this make sense?” Can understand various approaches to solutions.
 | * How would you describe the problem in your own words?
* How would you describe what you are trying to find?
* What do you notice about...?
* What information is given in the problem?
* Describe the relationship between the quantities.
* Describe what you have already tried. What might you change?
* Talk me through the steps you’ve used to this point.
* What steps in the process are you most confident about?
* What are some other strategies you might try?
* What are some other problems that are similar to this one?
* How might you use one of your previous problems to help you begin?
* How else might you organize...represent... show...?
 |
| **2. Reason abstractly and quantitatively.** |
| * Make sense of quantities and their relationships.
* Decontextualize (represent a situation symbolically and manipulate the symbols) and contextualize (make meaning of the symbols in a problem) quantitative relationships.
* Understand the meaning of quantities and are flexible in the use of operations and their properties.
* Create a logical representation of the problem.
* Attends to the meaning of quantities, not just how to compute them.
 | * What do the numbers used in the problem represent?
* What is the relationship of the quantities?
* How is \_\_\_\_\_\_\_ related to \_\_\_\_\_\_\_\_?
* What is the relationship between \_\_\_\_\_\_and \_\_\_\_\_\_?
* What does\_\_\_\_\_\_\_mean to you? (e.g. symbol, quantity, diagram)
* What properties might we use to find a solution?
* How did you decide in this task that you needed to use...?
* Could we have used another operation or property to solve this task? Why or why not?
 |
| **3. Construct viable arguments and critique the reasoning of others.** |
| * Analyze problems and use stated mathematical assumptions, definitions, and established results in constructing arguments.
* Justify conclusions with mathematical ideas.
* Listen to the arguments of others and ask useful questions to determine if an argument makes sense.
* Ask clarifying questions or suggest ideas to improve/revise the argument.
* Compare two arguments and determine correct or flawed logic.
 | * What mathematical evidence would support your solution?
* How can we be sure that...? / How could you prove that...?
* Will it still work if...?
* What were you considering when...?
* How did you decide to try that strategy?
* How did you test whether your approach worked?
* How did you decide what the problem was asking you to find? (What was unknown?)
* Did you try a method that did not work? Why didn’t it work? Would it ever work? Why or why not?
* What is the same and what is different about...?
* How could you demonstrate a counter-example?
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| **4. Model with mathematics.** |
| * Understand this is a way to reason quantitatively and abstractly (able to decontextualize and contextualize).
* Apply the mathematics they know to solve everyday problems.
* Are able to simplify a complex problem and identify important quantities to look at relationships.
* Represent mathematics to describe a situation either with an equation or a diagram and interpret the results of a mathematical situation.
* Reflect on whether the results make sense, possibly improving/revising the model.
* Ask them, “How can I represent this mathematically?”
 | * What number model could you construct to represent the problem?
* What are some ways to represent the quantities?
* What is an equation or expression that matches the diagram, number line..., chart..., table..?
* Where did you see one of the quantities in the task in your equation or expression?
* How would it help to create a diagram, graph, and table...?
* What are some ways to visually represent...?
* What formula might apply in this situation?
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| **5. Use appropriate tools strategically.** |
| * Use available tools recognizing the strengths and limitations of each Unit
* Use estimation and other mathematical knowledge to detect possible errors.
* Identify relevant external mathematical resources to pose and solve problems.
* Use technological tools to deepen their understanding of mathematics.
 | * What mathematical tools could we use to visualize and represent the situation?
* What information do you have?
* What do you know that is not stated in the problem?
* What approach are you considering trying first?
* What estimate did you make for the solution?
* In this situation would it be helpful to use...a graph..., number line..., ruler..., diagram..., calculator..., manipulative?
* Why was it helpful to use...?
* What can using a \_\_\_\_\_\_ show us that \_\_\_\_\_may not?
* In what situations might it be more informative or helpful to use...?
 |
| **6. Attend to precision.** |
| * Communicate precisely with others and try to use clear mathematical language when discussing their reasoning.
* Understand the meanings of symbols used in mathematics and can label quantities appropriately.
* Express numerical answers with a degree of precision appropriate for the problem context.
* Calculate efficiently and accurately.
 | * What mathematical terms apply in this situation?
* How did you know your solution was reasonable?
* Explain how you might show that your solution answers the problem.
* What would be a more efficient strategy?
* How are you showing the meaning of the quantities?
* What symbols or mathematical notations are important in this problem?
* What mathematical language...,definitions..., properties can you use to explain...?
* How could you test your solution to see if it answers the problem?
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| **7. Look for and make use of structure.** |
| * Apply general mathematical rules to specific situations.
* Look for the overall structure and patterns in mathematics.
* See complicated things as single objects or as being composed of several objects.
 | * What observations do you make about...?
* What do you notice when...?
* What parts of the problem might you eliminate.., simplify..?
* What patterns do you find in...?
* How do you know if something is a pattern?
* What ideas that we have learned before were useful in solving this problem?
* What are some other problems that are similar to this one?
* How does this relate to...?
* In what ways does this problem connect to other mathematical concepts?
 |
| **8. Look for and express regularity in repeated reasoning.** |
| * See repeated calculations and look for generalizations and shortcuts.
* See the overall process of the problem and still attend to the details.
* Understand the broader application of patterns and see the structure in similar situations.
* Continually evaluate the reasonableness of their intermediate results
 | * Explain how this strategy works in other situations?
* Is this always true, sometimes true or never true?
* How would we prove that...?
* What do you notice about...?
* What is happening in this situation?
* What would happen if...?
* Is there a mathematical rule for...?
* What predictions or generalizations can this pattern support?
* What mathematical consistencies do you notice?
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| **THIRD QUARTER (January 6 – March 12)** | **46 DAYS** |
| **Topic/Assessment** | **Dates Covered** | **Approximate # Days** |
| Unit 1: Functions and Graphs |  | 19 |
| Unit 2: Quadratic Functions |  | 12 |
| Unit 3: Polynomial Functions  |  | 11 |
| District Assessment (1 day); FSA ELA/Writing (1 day); 9 Weeks Exams (2 days) |  | 4 |
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| **FOURTH QUARTER (March 23 – May 27)**  | **46 DAYS** |
| **Topic/Assessment** | **Dates Covered** | **Approximate # Days** |
| Unit 4: Rational Expressions and Functions |  | 12 |
| Unit 5: Exponential and Logarithmic Functions |  | 16 |
| Unit 6: Trigonometry  |  | 8 |
| FSA (7 days); 9 Weeks Exams (3 days) |  | 10 |

*\*Please note that the suggested number of instructional days per unit and quarter are designed to be a guide. Teachers are encouraged to work within their schools and their PLCs to make the most appropriate timing decisions for their students.\**

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| **Unit 1: Functions and Graphs**  |
| **Code** | **Mathematics Florida Standard** | **SMP** |
| F-IF.3.7 | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.1. Graph linear and quadratic functions and show intercepts, maxima, and minima.
2. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
 | 5, 6, 8 |
| F-BF.1.1 | Write a function that describes a relationship between two quantities.1. Determine an explicit expression, a recursive process, or steps for calculation from a context.
2. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.
3. Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.
 | 1, 2, 4, 5 |
| F-BF.2.4 | Find inverse functions.1. Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. For example, f(x) =2 x³ or f(x) = (x+1)/(x–1) for x ≠ 1.
2. Verify by composition that one function is the inverse of another.
3. Read values of an inverse function from a graph or a table, given that the function has an inverse.
4. Produce an invertible function from a non-invertible function by restricting the domain.
 | 3, 5, 8 |
| **Learning Goal and Scale** | **Instructional Strategies & Misconceptions**  |
| [**AF05:** Students will be able to build functions that model relationships between quantities (inverse/composite) from existing functions.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af05.docx)   |  |
| **Math Practices for Unit** | **Unit Connections** | **Instructional Resources** |
| 1. Make sense of problems and persevere in solving them. | 5. Use appropriate tools strategically. |  |  |  |
| 2. Reason abstractly and quantitatively. | 6. Attend to precision. |
| 3. Construct viable arguments & critique reasoning of others. | 7. Look for and make use of structure. |
| 4. Model with mathematics. | 8. Look for and express regularity in repeated reasoning. |

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| **THIRD QUARTER** |
| **Unit 1: Functions and Graphs** |
| **Learning Goal** | [**AF05:** Students will be able to build functions that model relationships between quantities (inverse/composite) from existing functions.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af05.docx)   | **Suggested # of Days** | **19** |
| **Approx. # of Day(s)** | **MAFS** | **Lesson Objective (Instructional Resources)** | **Suggested Assignments/Assessments** | **Ancillary Materials** |
| 3 | F-IF.3.7 | 2.1 Basic Functions and Their Graphs |  |  |
| 2 | 2.2 More Functions and Their Graphs |  |  |
| 2 | 2.3 Linear Functions and Slope |  |  |
| 3 | 2.5 Transformations of Functions |  |  |
| 4 | F-BF.1.1 | 2.6 Combinations of Functions; Composite Functions |  |  |
| 3 | F-BF.2.4 | 2.7 Inverse Functions |  |  |
| 2 |  | Review/Assessments |  |  |

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| **Unit 2: Quadratic Functions**  |
| **Code** | **Mathematics Florida Standard** | **SMP** |
| F-IF.3.7 | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.1. Graph linear and quadratic functions and show intercepts, maxima, and minima.
 | 1, 2, 5 |
| F-IF.3.8 | Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. 1. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
 | 1, 2, 5, 8 |
| N-CN-3.9 | Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. | 1, 2, 4 |
| **Learning Goal and Scale** | **Instructional Strategies & Misconceptions**  |
| [**AF02:** Students will be able to write functions in equivalent forms and graph functions with and without technology.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af02.docx)   |  |
| **Math Practices for Unit** | **Unit Connections** | **Instructional Resources** |
| 1. Make sense of problems and persevere in solving them. | 5. Use appropriate tools strategically. |  |  |  |
| 2. Reason abstractly and quantitatively. | 6. Attend to precision. |
| 3. Construct viable arguments & critique reasoning of others. | 7. Look for and make use of structure. |
| 4. Model with mathematics. | 8. Look for and express regularity in repeated reasoning. |

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| **THIRD QUARTER** |
| **Unit 2: Quadratic Functions**  |
| **Learning Goal** | [**AF02:** Students will be able to write functions in equivalent forms and graph functions with and without technology.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af02.docx)   | **Suggested # of Days** | **12** |
| **Approx. # of Day(s)** | **MAFS** | **Lesson Objective (Instructional Resources)** | **Suggested Assignments/Assessments** | **Ancillary Materials** |
| 3 | F-IF.3.8 | P.5 Factoring Polynomials |  |  |
| 4 | F-IF.3.8N-CN.3.9 | 1.5 Quadratic Equations |  |  |
| 3 | F-IF.3.7N-CN.3.9 | 3.1 Quadratic Functions |  |  |
| 2 |  | Review/Assessments |  |  |

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| **Unit 3: Polynomial Functions**  |
| **Code** | **Mathematics Florida Standard** | **SMP** |
| N-CN.3.9 | Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. | 2,3,7 |
| A-APR.2.2 | Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x). | 1,5,6 |
| F-IF.3.7 | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.1. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
2. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
 | 1,3,5 |
| F-IF.3.8 | Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. 1. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
 | 1, 3,5 |
| **Learning Goal and Scale** | **Instructional Strategies & Misconceptions**  |
| [**AF01:** Students will be able to solve mathematical problems using the Fundamental Theorem of Algebra and the Reminder Theorem.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af01.docx)[**AF02:** Students will be able to write functions in equivalent forms and graph functions with and without technology.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af02.docx)   |  |
| **Math Practices for Unit** | **Unit Connections** | **Instructional Resources** |
| 1. Make sense of problems and persevere in solving them. | 5. Use appropriate tools strategically. |  |  |  |
| 2. Reason abstractly and quantitatively. | 6. Attend to precision. |
| 3. Construct viable arguments & critique reasoning of others. | 7. Look for and make use of structure. |
| 4. Model with mathematics. | 8. Look for and express regularity in repeated reasoning. |

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| **THIRD QUARTER** |
| **Unit 3: Polynomial Functions**  |
| **Learning Goal** | [**AF01:** Students will be able to solve mathematical problems using the Fundamental Theorem of Algebra and the Reminder Theorem.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af01.docx)[**AF02:** Students will be able to write functions in equivalent forms and graph functions with and without technology.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af02.docx)   | **Suggested # of Days** | **11****(4)** |
| **Approx. # of Day(s)** | **MAFS** | **Lesson Objective (Instructional Resources)** | **Suggested Assignments/Assessments** | **Ancillary Materials** |
| 3 | N-CN.3.9F-IF.3.7 F-IF.3.8 | 3.2 Polynomial Functions and Their Graphs |  |  |
| 3 | A-APR.2.2 | 3.3 Dividing Polynomials; Remainder and Factor Theorems |  |  |
| 3 | N-CN.3.9F-IF.3.8 | 3.4 Zeros of Polynomial Functions |  |  |
| 2 |  | Review/Assessments |  |  |
| **4** |  | District Assessment (1 day); FSA ELA/Writing (1 day); 9 Weeks Exams (2 days) |  |  |

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| **Unit 4: Rational Expressions and Functions**  |
| **Code** | **Mathematics Florida Standard** | **SMP** |
| F-IF.3.7 | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.1. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
 | 1, 3, 5 |
| A-APR.4.6 | Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system | 3, 6, 7 |
| A-APR.4.7 | Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. | 3, 6, 7 |
| **Learning Goal and Scale** | **Instructional Strategies & Misconceptions**  |
| [**AF04**: Students will be able to rewrite rational expressions.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af04.docx)   |  |
| **Math Practices for Unit** | **Unit Connections** | **Instructional Resources** |
| 1. Make sense of problems and persevere in solving them. | 5. Use appropriate tools strategically. |  |  |  |
| 2. Reason abstractly and quantitatively. | 6. Attend to precision. |
| 3. Construct viable arguments & critique reasoning of others. | 7. Look for and make use of structure. |
| 4. Model with mathematics. | 8. Look for and express regularity in repeated reasoning. |

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| **FOURTH QUARTER** |
| **Unit 4: Rational Expressions and Functions**  |
| **Learning Goal** | [**AF04**: Students will be able to rewrite rational expressions.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af04.docx)   | **Suggested # of Days** | **12** |
| **Approx. # of Day(s)** | **MAFS** | **Lesson Objective (Instructional Resources)** | **Suggested Assignments/Assessments** | **Ancillary Materials** |
| 4 | A-APR.4.6A-APR.4.7 | P.6 Rational Expressions |  |  |
| 5 | F-IF.3.7 | 3.5 Rational Functions and their Graphs |  |  |
| 3 |  | Review/Assessments |  |  |

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| **Unit 5: Exponential and Logarithmic Functions**  |
| **Code** | **Mathematics Florida Standard** | **SMP** |
| F-BF.2.5 | Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. | 1, 3, 5, 7 |
| F-IF.3.7 | Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.1. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude
 | 1, 3, 5 |
| F-IF.3.8 | Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. 1. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)t, y = (0.97)t, y = (1.01)12t, y = (1.2)t/10,and classify them as representing exponential growth or decay.
 | 1, 3, 5 |
| F-LE.1.4 | Express as a logarithm the solution to $ab^{ct}=d$, where a, c, and d are numbers and the base b is 2, 10, or e. Evaluate Logarithms using technology | 1, 5, 7 |
| **Learning Goal and Scale** | **Instructional Strategies & Misconceptions**  |
| [**AF03:** Students will be able to write exponential and logarithmic functions in equivalent forms and graph with and without technology.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af03.docx) |  |
| **Math Practices for Unit** | **Unit Connections** | **Instructional Resources** |
| 1. Make sense of problems and persevere in solving them. | 5. Use appropriate tools strategically. |  |  |  |
| 2. Reason abstractly and quantitatively. | 6. Attend to precision. |
| 3. Construct viable arguments & critique reasoning of others. | 7. Look for and make use of structure. |
| 4. Model with mathematics. | 8. Look for and express regularity in repeated reasoning. |

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| **FOURTH QUARTER** |
| **Unit 5: Exponential and Logarithmic Functions**  |
| **Learning Goal** | [**AF03:** Students will be able to write exponential and logarithmic functions in equivalent forms and graph with and without technology.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af03.docx) | **Suggested # of Days** | **16** |
| **Approx. # of Day(s)** | **MAFS** | **Lesson Objective (Instructional Resources)** | **Suggested Assignments/Assessments** | **Ancillary Materials** |
| 2 | F-IF.3.7F-IF.3.8 | 4.1 Exponential Functions |  |  |
| 3 | F-IF.3.7F-BF.2.5F-LE.1.4 | 4.2 Logarithmic Functions |  |  |
| 3 | F-IF.3.8 | 4.3 Properties of Logarithms |  |  |
| 3 | F-BF.2.5 | 4.4 Exponential and Logarithmic Equations |  |  |
| 3 | F-IF.3.8F-IF.3.7 | 4.5 Exponential Growth and Decay; Modeling Data |  |  |
| 2 |  | Review/Assessments |  |  |

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| **Unit 6: Trigonometry** |
| **Code** | **Mathematics Florida Standard** | **SMP** |
| F-TF.1.3 | Use special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4 and π/6, and use the unit circle to express the values of sine, cosine, and tangent for π–x, π+x, and 2π–x in terms of their values for x, where x is any real number (conterminal angle). | 5, 6 |
| F-TF.1.4 | Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions. | 2, 3 |
| F-TF.2.5 | Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. | 4, 5, 7, 8 |
| F-TF.2.6 | Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed. | 1, 2 |
| F-TF.2.7 | Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. | 1, 4, 5 |
| F-TF.3.8 | Prove the Pythagorean identity sin²(θ) + cos²(θ) = 1 and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) and the quadrant of the angle. | 3,7 |
| **Learning Goal and Scale** | **Instructional Strategies & Misconceptions**  |
| [**AF06**: Students will be able to extend the domain of trigonometric functions using the unit circle.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af06.docx)[**AF07**: Students will be able to model periodic phenomena using trigonometric functions.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af07.docx)[**AF08**: Students will be able to prove and apply trigonometric identities.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af08.docx) |  |
| **Math Practices for Unit** | **Unit Connections** | **Instructional Resources** |
| 1. Make sense of problems and persevere in solving them. | 5. Use appropriate tools strategically. |  |  |  |
| 2. Reason abstractly and quantitatively. | 6. Attend to precision. |
| 3. Construct viable arguments & critique reasoning of others. | 7. Look for and make use of structure. |
| 4. Model with mathematics. | 8. Look for and express regularity in repeated reasoning. |

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| **FOURTH QUARTER** |
| **Unit 6: Trigonometry** |
| **Learning Goal** | [**AF06:** Students will be able to extend the domain of trigonometric functions using the unit circle.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af06.docx)[**AF07:** Students will be able to model periodic phenomena using trigonometric functions.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af07.docx)[**AF08:** Students will be able to prove and apply trigonometric identities.](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/af08.docx) | **Suggested # of Days** | **8****(10)** |
| **Approx. # of Day(s)** | **MAFS** | **Lesson Objective (Instructional Resources)** | **Suggested Assignments/Assessments** | **Ancillary Materials** |
| 1 | F-TF.1.3 | Right Triangle Trig Evaluating RatiosRight Triangle Trig Missing Sides and Angles | Trig. Worksheet #[1](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/right_triangle_trig_evaluating_ratios.pdf) & [2](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/right_triangle_trig_missing_sides_and_angles.pdf) |  |
| 1 | F-TF.1.3F-TF.1.4 | Angles and Angle MeasureExact Trig Values of Special Angles | Trig. Worksheet #[3](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/angles_and_angle_measure.pdf) & [4](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/exact_trig_values_of_special_angles.pdf) |  |
| 1 | F-TF.1.3 | Trig Ratios of General AnglesCoterminal Angles and Reference Angles | Trig. Worksheet #[5](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/trig_ratios_of_general_angles.pdf) & [6](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/coterminal_angles_and_reference_angles.pdf) |  |
| 1 | F-TF.1.4F-TF.2.5F-TF.2.6F-TF.2.7 | Graphing Trig FunctionsTranslating Trig Graphs | Trig. Worksheet #[7](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/graphing_trig_functions.pdf) & [8](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/translating_trig_graphs.pdf) |  |
| 1 | F-TF.3.8 | Angle Sum and Difference IdentitiesDouble and Half Angle Identities | Trig. Worksheet #[9](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/angle_sum_and_difference_identities.pdf) & [10](http://scpsmath.weebly.com/uploads/2/9/1/7/29174797/double_and_half_angle_identities.pdf) |  |
| 3 |  | Review/Assessments |  |  |
| **10** |  | FSA (7 days); 9 Weeks Exams (3 days) |  |  |